

Chapter 2.2

Class 2 – Gases

2.2.0 Introductory note

“Toxic” has the same meaning as “poisonous”.

2.2.1 Definitions and general provisions

2.2.1.1 A gas is a substance which:

- .1 at 50°C has a vapour pressure greater than 300 kPa; or
- .2 is completely gaseous at 20°C at a standard pressure of 101.3 kPa.

2.2.1.2 The transport condition of a gas is described according to its physical state as:

- .1 *compressed gas*: a gas which when packaged under pressure for transport is entirely gaseous at –50°C; this category includes all gases with a critical temperature less than or equal to –50°C;
- .2 *liquefied gas*: a gas which when packaged under pressure for transport is partially liquid at temperatures above –50 °C. A distinction is made between:
 - high pressure liquefied gas*: a gas with a critical temperature between –50°C and +65°C, and
 - low pressure liquefied gas*: a gas with a critical temperature above +65°C;
- .3 *refrigerated liquefied gas*: a gas which when packaged for transport is made partially liquid because of its low temperature;
- .4 *dissolved gas*: a gas which when packaged under pressure for transport is dissolved in a liquid phase solvent;
- .5 *adsorbed gas*: a gas which when packaged for transport is adsorbed onto a solid porous material resulting in an internal receptacle pressure of less than 101.3 kPa at 20°C and less than 300 kPa at 50°C.

△ 2.2.1.3 The class comprises compressed gases, liquefied gases, dissolved gases, refrigerated liquefied gases, adsorbed gases, mixtures of one or more gases with one or more vapours of substances of other classes, articles charged with a gas, aerosols and chemicals under pressure.

2.2.1.4 Gases are normally transported under pressure varying from high pressure in the case of compressed gases to low pressure in the case of refrigerated gases.

2.2.1.5 According to their chemical properties or physiological effects, which may vary widely, gases may be: flammable; non-flammable; non-toxic; toxic; supporters of combustion; corrosive; or may possess two or more of these properties simultaneously.

2.2.1.5.1 Some gases are chemically and physiologically inert. Such gases as well as other gases, normally accepted as non-toxic, will nevertheless be suffocating in high concentrations.

2.2.1.5.2 Many gases of this class have narcotic effects which may occur at comparatively low concentrations or may evolve highly toxic gases when involved in a fire.

2.2.1.5.3 All gases which are heavier than air will present a potential danger if allowed to accumulate in the bottom of cargo spaces.

2.2.2 Class subdivisions

Class 2 is subdivided further according to the primary hazard of the gas during transport:

△ **Note:** For UN 1950 AEROSOLS, see also the criteria in special provision 63. For chemicals under pressure of UN Nos. 3500 to 3505, see also special provision 362. For UN 2037 RECEPTACLES, SMALL, CONTAINING GAS (GAS CARTRIDGES), see also special provision 303.

2.2.2.1 Class 2.1 Flammable gases

Gases which at 20°C and a standard pressure of 101.3 kPa:

- .1 are ignitable when in a mixture of 13% or less by volume with air; or
- △ .2 have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Flammability shall be determined by tests or calculation in accordance with methods adopted by the International Organization for Standardization (see ISO 10156:2017). Where insufficient data are available to use these methods, tests by a comparable method recognized by a national competent authority may be used.

2.2.2.2 Class 2.2 Non-flammable, non-toxic gases

Gases which:

- .1 are asphyxiant – gases which dilute or replace the oxygen normally in the atmosphere; or
 - .2 are oxidizing – gases which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does; or
 - .3 do not come under the other classes.
- △ **Note:** In 2.2.2.2, “gases which cause or contribute to the combustion of other material more than air does” means pure gases or gas mixtures with an oxidizing power greater than 23.5% as determined by a method specified in ISO 10156:2017.

2.2.2.3 Class 2.3 Toxic gases

Gases which:

- .1 are known to be so toxic or corrosive to humans as to pose a hazard to health; or
- .2 are presumed to be toxic or corrosive to humans because they have a LC₅₀ value (as defined in 2.6.2.1) equal to or less than 5,000 mL/m³ (ppm).

Note: Gases meeting the above criteria owing to their corrosivity are to be classified as toxic with a subsidiary corrosive hazard.

2.2.2.4 Gases and gas mixtures with hazards associated with more than one division take the following precedence:

- .1 class 2.3 takes precedence over all other classes;
- .2 class 2.1 takes precedence over class 2.2.

2.2.2.5 Gases of class 2.2 are not subject to the provisions of this Code if they are transported at a pressure of less than 200 kPa at 20°C and are not liquefied or refrigerated liquefied gases.**2.2.2.6 Gases of class 2.2 are not subject to the provisions of this Code when contained in the following:**

- .1 foodstuffs (except UN 1950), including carbonated beverages;
- .2 balls intended for use in sports; or
- .3 tyres (except for air transport).

Note: This exemption does not apply to lamps. For lamps see 1.1.1.9.

2.2.3 Mixtures of gases

For the classification of gas mixtures (including vapours of substances from other classes), the following principles shall be used:

- △ .1 Flammability shall be determined by tests or calculation in accordance with methods adopted by the International Organization for Standardization (see ISO 10156:2017). Where insufficient data are available to use these methods, tests by a comparable method recognized by a national competent authority may be used.
- .2 The level of toxicity is determined either by tests to measure the LC₅₀ value (as defined in 2.6.2.1) or by a calculation method using the following formula:

$$LC_{50} \text{ Toxic (mixture)} = \frac{1}{\sum_{i=1}^n \frac{f_i}{T_i}}$$

where: f_i = mole fraction of the i^{th} component substance of the mixture;

T_i = toxicity index of the i^{th} component substance of the mixture (the T_i equals the LC₅₀ value when available).

When LC₅₀ values are unknown, the toxicity index is determined by using the lowest LC₅₀ value of substances of similar physiological and chemical effects, or through testing if this is the only practical possibility.

- .3 A gas mixture has a subsidiary hazard of corrosivity when the mixture is known by human experience to be destructive to the skin, eyes or mucous membranes or when the LC₅₀ value of the corrosive components of the mixture is equal to or less than 5,000 mL/m³ (ppm) when the LC₅₀ is calculated by the formula:

$$LC_{50} \text{ Corrosive (mixture)} = \frac{1}{\sum_{i=1}^n \frac{f_{ci}}{T_{ci}}}$$

where: f_{ci} = mole fraction of the i^{th} corrosive component substance of the mixture;

T_{ci} = toxicity index of the i^{th} corrosive component substance of the mixture (the T_{ci} equals the LC₅₀ value when available).

- .4 Oxidizing ability is determined either by tests or by calculation methods adopted by the International Organization for Standardization (see note in 2.2.2.2).

2.2.4 Gases not accepted for transport

Chemically unstable gases of class 2 shall not be accepted for transport unless the necessary precautions have been taken to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of transport or unless transported in accordance with special packing provision (r) of packing instruction P200 (5) of 4.1.4.1, as applicable. For the precautions necessary to prevent polymerization, see special provision 386 of chapter 3.3. To this end particular care shall be taken to ensure that receptacles and tanks do not contain any substances liable to promote these reactions.

